VORTEX TUBE REFRIGERATION

TECHNO-TRACK 2018

GOVT. POLYTECHNIC HIMATNAGAR

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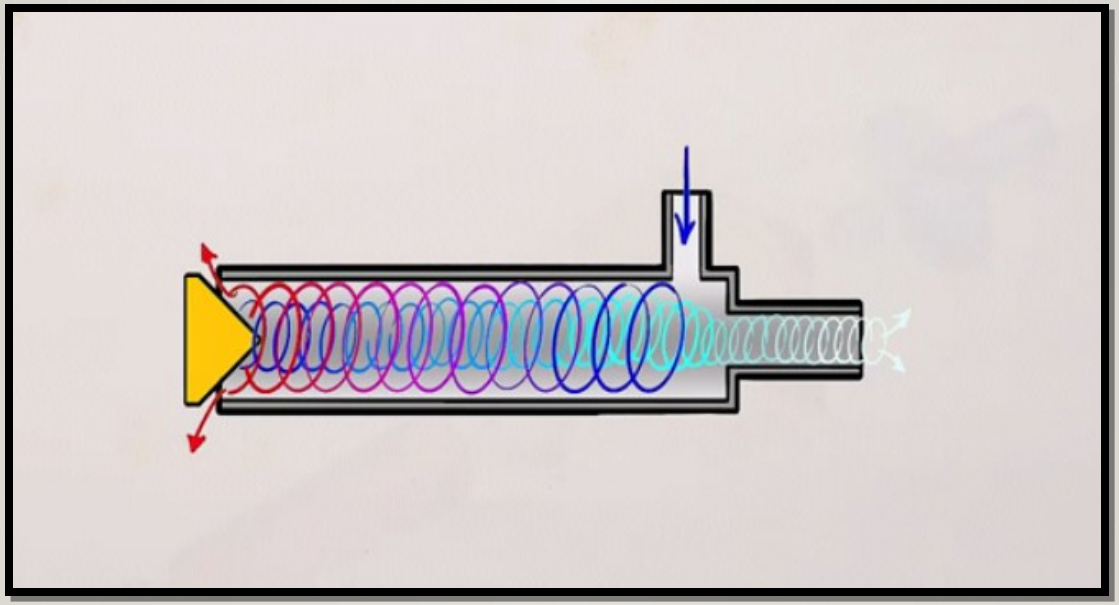
INTRODUCTION



“A vortex tube is device, which produces cooling at one end and heating at another end simultaneously without any moving part if high pressure air is supplied at inlet”

BACKGROUND HISTORY

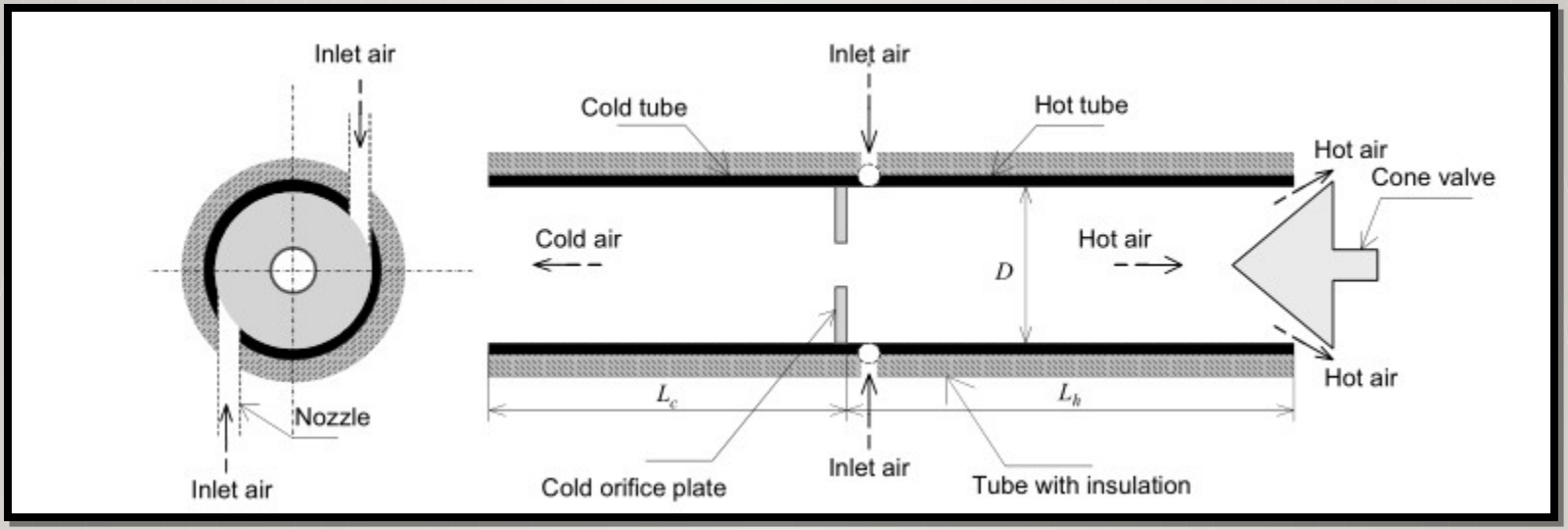
- Discovered by Frenchman *George Ranque,* while working on air cyclone separator project.
- Interest further revived by a German professor *Rudolf Hilsch.*

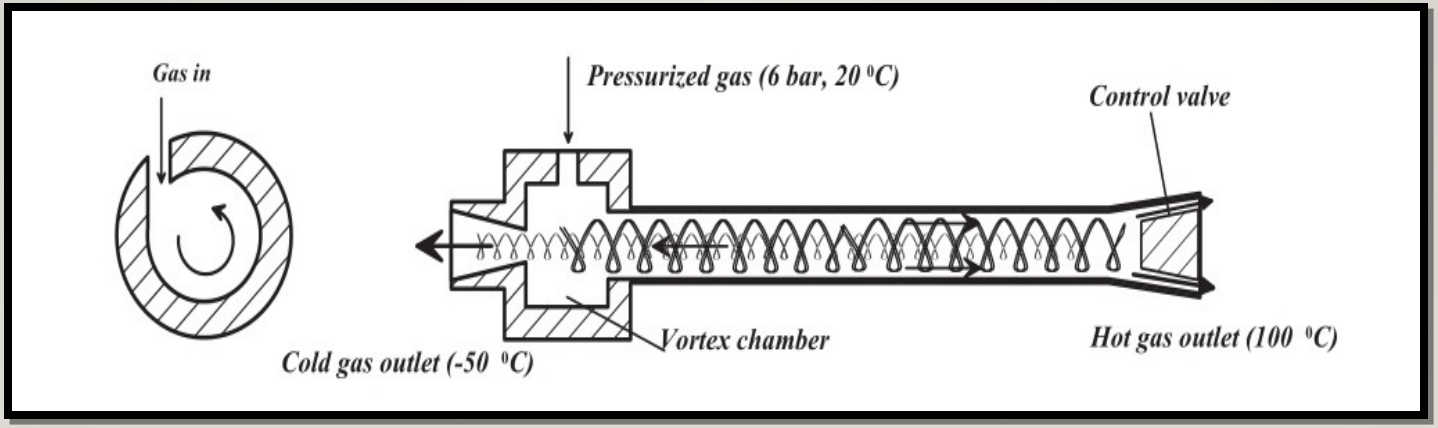
- In memory of *Ranque and Hilsch* who have highly contributed in development of vortex tube it is also called as Ranque-Hilsch vortex tube (RHVT).

DESCRIPTION OF VORTEX TUBE

Parts of vortex tube

- Nozzle
- Chamber
- Hot side tube
- Control valve
- Orifice
- Cold side tube


Inlet air
Inlet air
Cold tube
Hot tube
Hot air
Cone valve
Cold air
Hot air
D
Nozzle
Hot air
L_c
L_h
Inlet air
Inlet air
Cold orifice plate
Tube with insulation


Gas in
Pressurized gas (6 bar, 20 ^{0}C)
Control valve
Vortex chamber
Cold gas outlet (-50 ^{0}C)
Hot gas outlet (100 ^{0}C)

WORKING

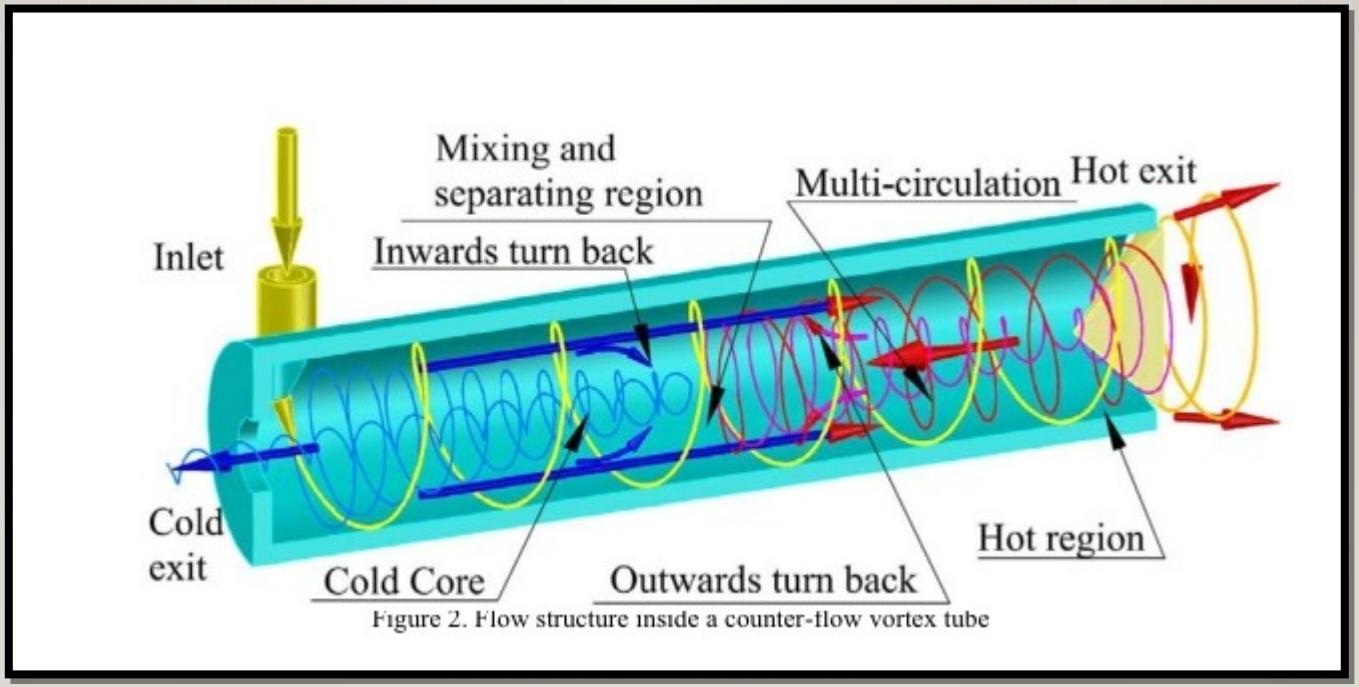
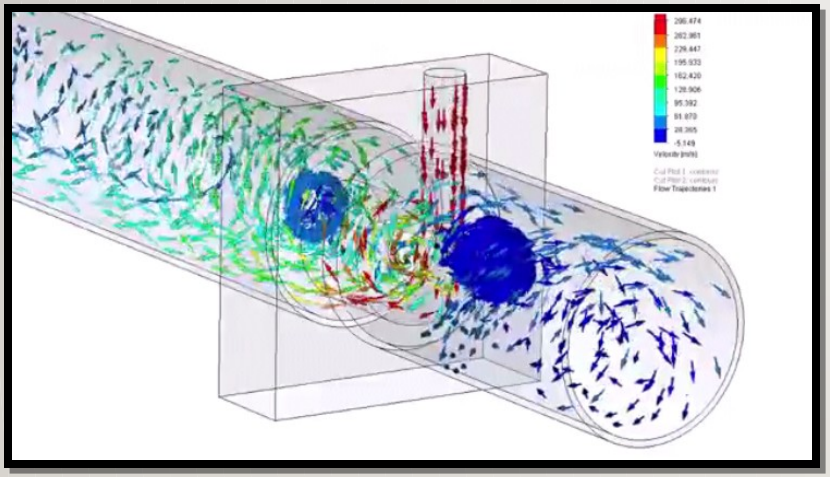
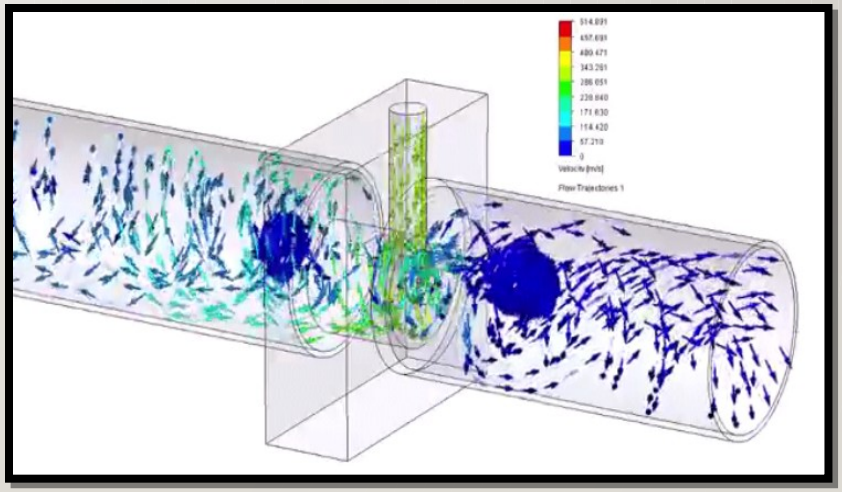


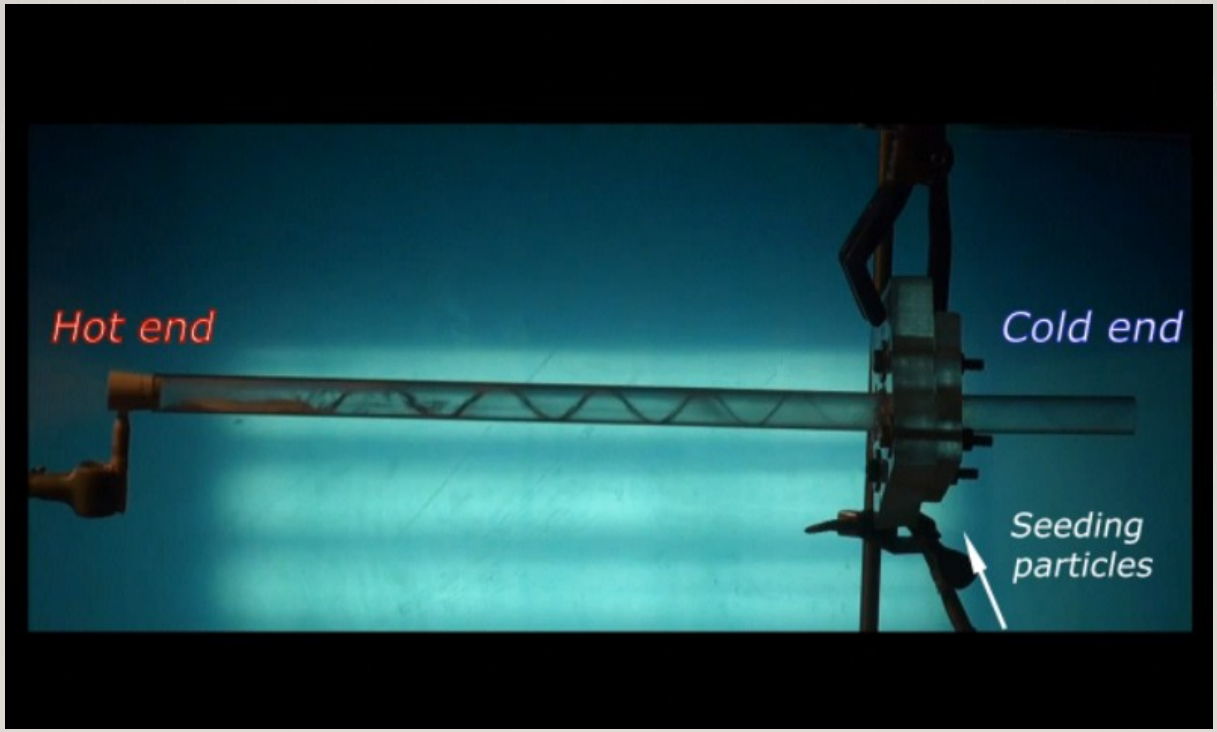
Figure 2. Flow structure inside a counter-flow vortex tube

Cad Simulations

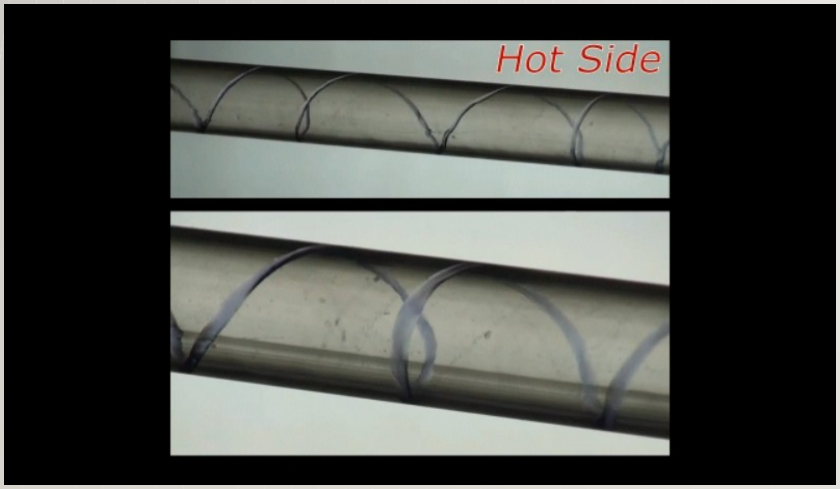


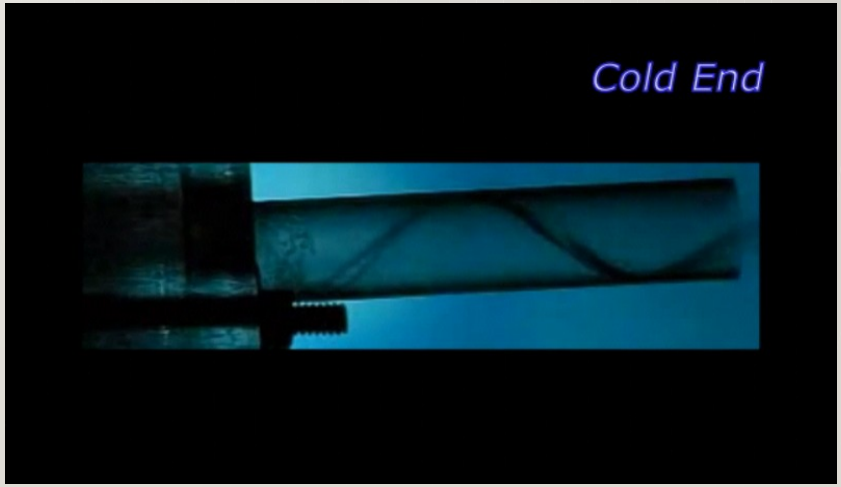


How Air Flows Inside Tube ?

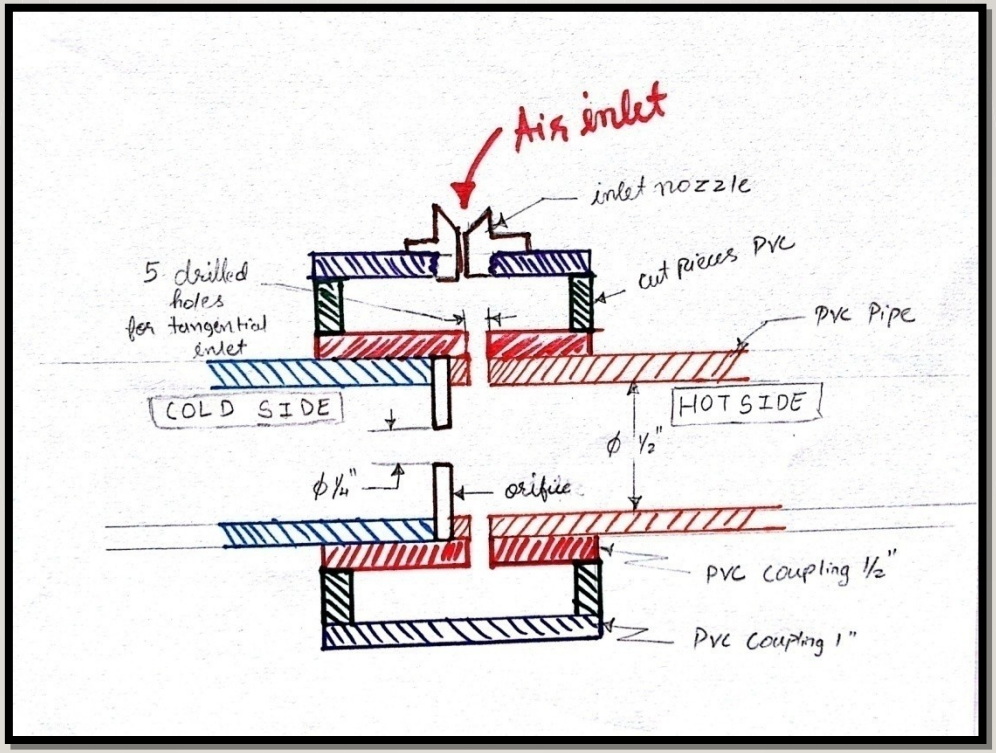


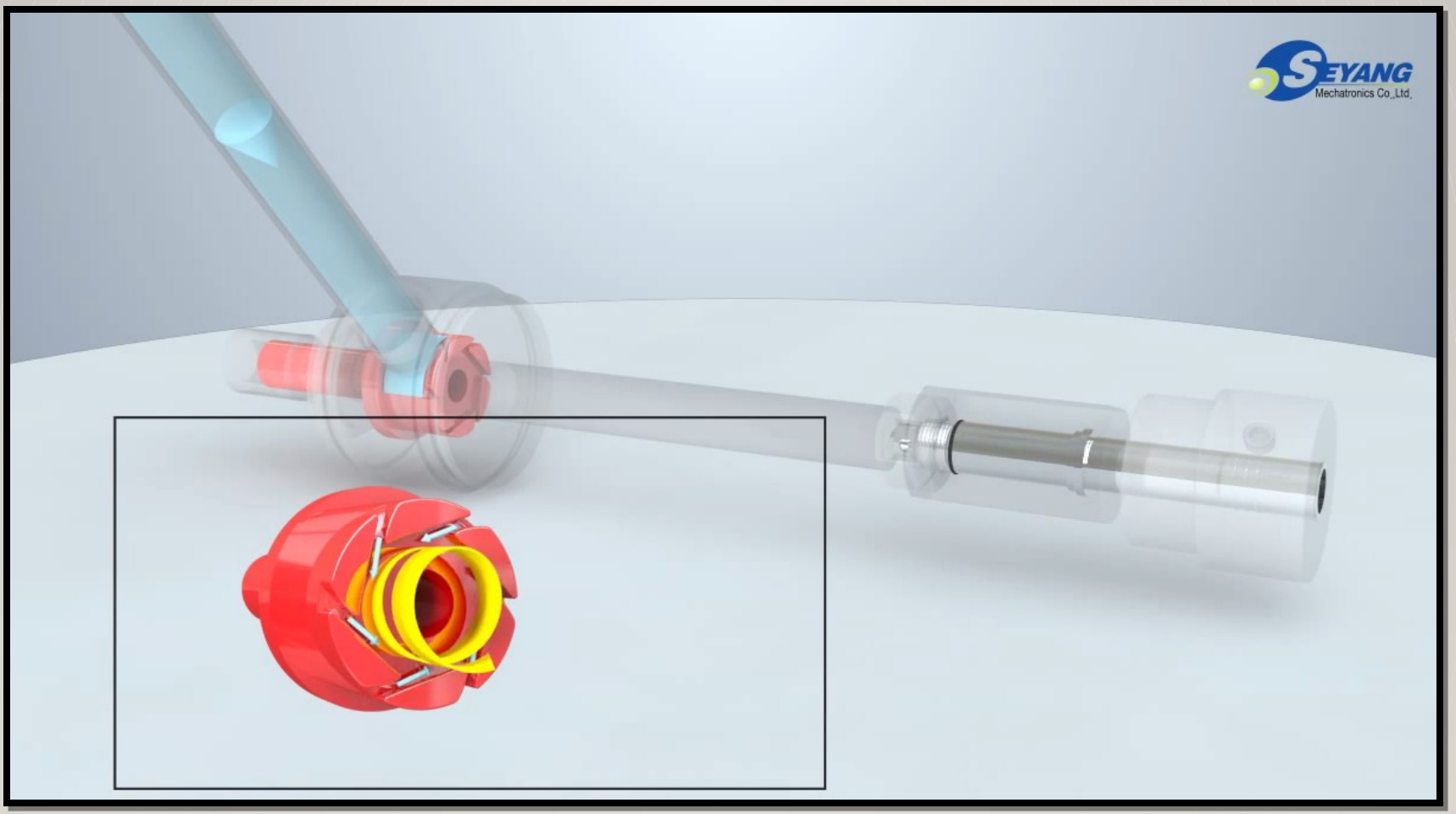
How Air Flows Inside Tube ?





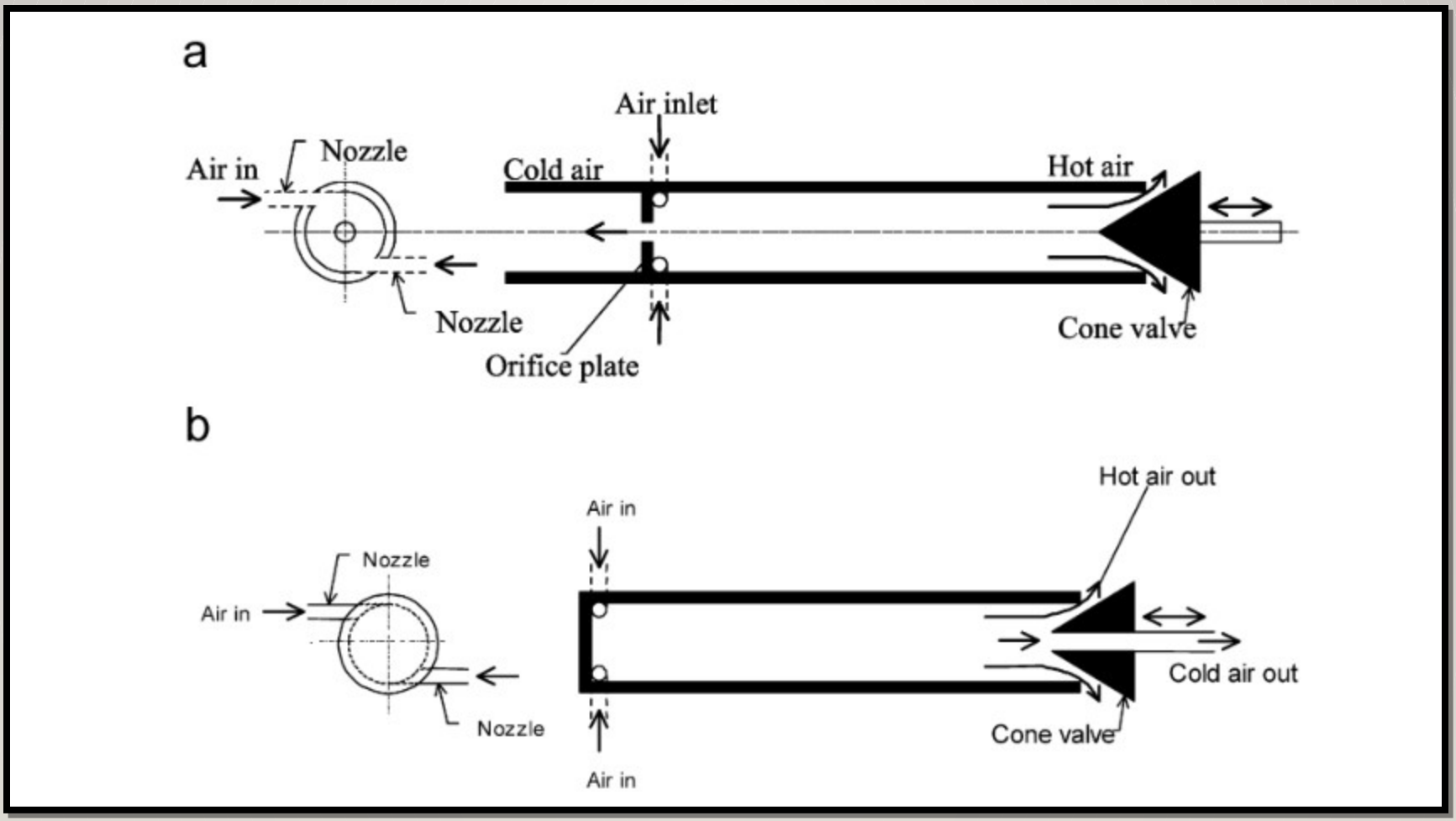
Chamber Design




SEYANG
Mechatronics Co.,Ltd.

TYPES OF VORTEX TUBE

- **Counter flow type vortex tube**
- **Uni-flow type vortex tube**


a
Air inlet
Air in
Nozzle
Cold air
Hot air
Nozzle
Orifice plate
Cone valve
b
Hot air out
Air in
Nozzle
Air in
Cold air out
Nozzle
Cone valve
Air in

ADVANTAGES

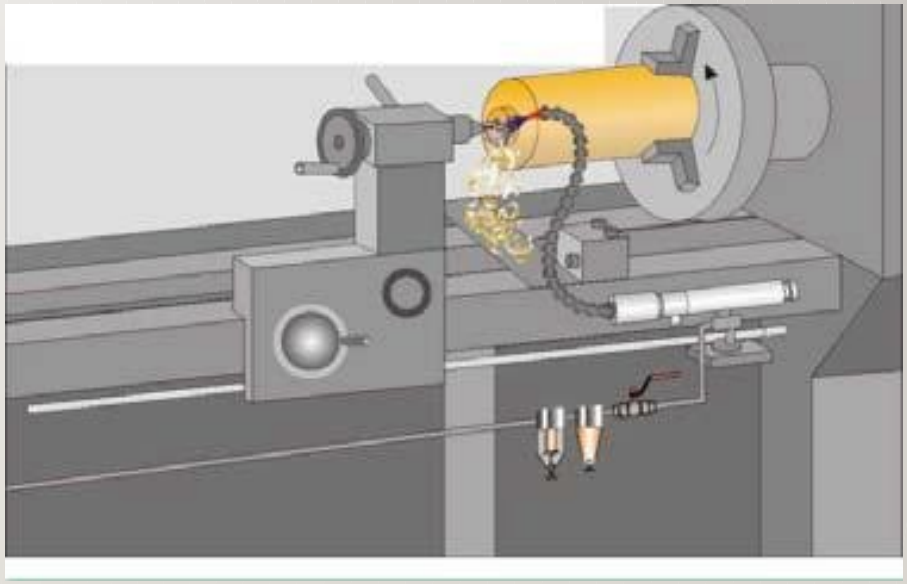
- No leakage problem as air is used.
- Initial cost is low.
- Design is simpler, functioning is also simple.
- No moving parts, no maintenance required.
- Light in weight plus compact in size.

DISADVANTAGE

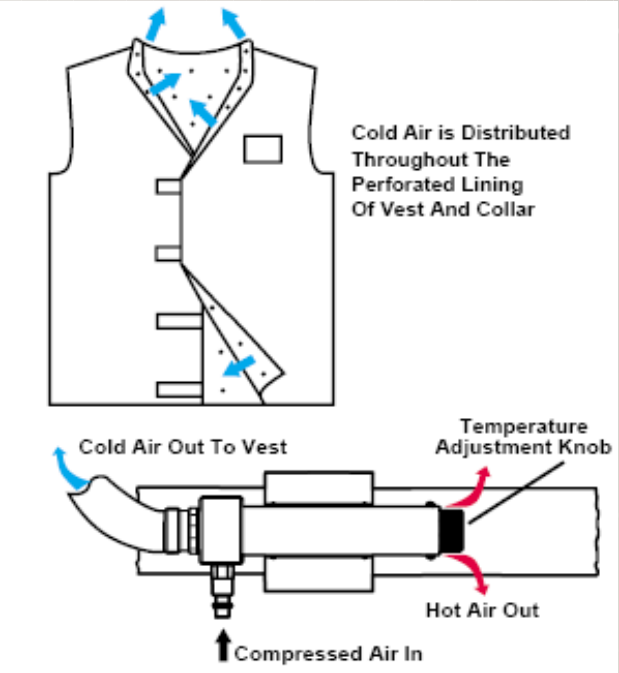
- Low COP of system.
- Not suitable for large capacity refrigeration unit.

APPLICATION

- When compactness, reliability and lower equipment cost are the main factors and the operating efficiency becomes less important, the RHVT becomes a nice device.
- As cooling equipment in CNC machines, refrigerators, cooling suits.

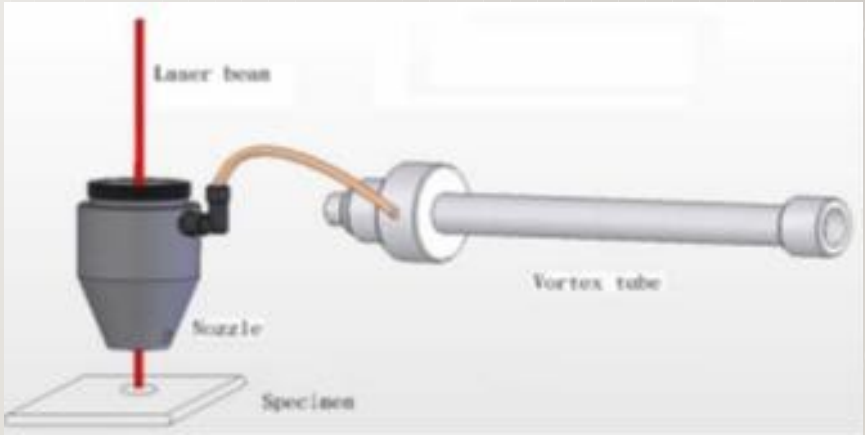


- Can be used to for body cooling of workers of mines.
- Since vortex tube is able to deliver hot and cold air simultaneously, it is also used when heating and cooling is required simultaneously.



- Vortex tube can be used for shrink fitting, where refrigeration is required for short period.
- It is used to cool certain commodities at a temperature of -50 C by direct chilling.

- Can be used for cooling of cutting tools in workshop. This is especially true for those materials for which use of coolant is not permitted.



THANK YOU